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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/075,802

02/14/2002

Ernst Klotz

P02,0037

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26574

7590

03/08/2006

SCHIFF HARDIN, LLP  
PATENT DEPARTMENT  
6600 SEARS TOWER  
CHICAGO, IL 60606-6473

EXAMINER

LAVIN, CHRISTOPHER L

ART UNIT

PAPER NUMBER

2621

DATE MAILED: 03/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/075,802

Applicant(s)

KLOTZ ET AL.

Examiner

Christopher L. Lavin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 12 December 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 February 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
  - 2) ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
2. Claims 1 – 5, 11, and 15 – 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uppaluri (6,466,687) in view of Heuscher (5,396,418).

In regards to claim 1, A method for processing a computed tomography image comprising the steps of: obtaining a computed tomography image of a lung of a subject [with contrast agent administered to the subject so as to affect said image], said image being comprised of pixels each having a Hounsfield Unit (HU) value associated therewith and each having a gray scale associated therewith dependent on the HU value thereof (col. 4, lines 13 – 22: CT images are measured using HU values. The grey scale images represent HU values in the image.); determining pixels representing pulmonary parenchyma in said image, as pulmonary parenchyma pixels (col. 4, lines 36 – 43; col. 18, lines 6 – 18); and generating a processed image by presenting al of said pulmonary parenchyma pixels in false colors respectively corresponding to different HU values and presenting remaining pixels in said image in said gray scale values (col. 6, line 33 – col. 7, line 66; col. 20, lines 8 – 17; col. 21, 52 – 65: By overlaying the colored image onto the gray scale image Uppaluri is accomplishing this step. Uppaluri uses the histogram analysis of the HU values to identify different areas and types of parenchyma pixels, these pixels are then assigned a false color. Different HU values represent different areas of the parenchyma. Reading the remarks included with the amendment it

is clear that the applicant would intends a narrow reading to the newly added claim language in this paragraph. However, the applicant is entitled to the broadest possible interruption of the language and therefore the interruption provided above is adequate. The applicant could overcome this rejection by further detailing how false colors are assigned based on HU values, as the applicant is intending a much more direct process that Uppaluri discloses.).

Uppaluri is silent on the issue of contrast agents. However it is well known in the art as shown by Heuscher (col. 7, lines 50 – 62) to use a contrast agent with a CT system to bring out vessels in the image.

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to use a contrast agent (as taught by Heuscher) in the method disclosed by Uppaluri. By using a contrast agent blood vessels will be brought out in the image, which will let Uppaluri more easily identify the blood vessels. This will simplify the classification process.

In regards to claim 2, A method as claimed in claim 1 wherein the step of determining the pulmonary parenchyma pixels comprises applying a contour finding algorithm to said image and thereby separating said pulmonary parenchyma pixels from said remaining pixels (col. 4, lines 36 – 63).

In regards to claim 3, A method as claimed in claim 1 comprising determining said pulmonary parenchyma pixels, together with pixels representing bronchia and vessels, based on said HU values, and removing said pixels representing bronchia and vessels from said pulmonary parenchyma pixels (col. 18, lines 5 – 18; col. 21, line 66 –

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col. 22, line 10: CT images are measured using HU values. The grey scale images represent HU values in the image. The image areas are classified based on the grey scale values.).

In regards to claim 4, A method as claimed in claim 3 wherein said pulmonary parenchyma pixels and said pixels representing bronchia and vessels comprise a totality of pixels, and comprising removing only a portion of said totality of pixels which does not exceed a predetermined maximum percentage of said totality of pixels (col. 21, 66 – col. 22, 10: As classification groups can be removed from the image, amongst those groups is broncho-vascular, the bronchia and vessels can be removed. As only the pixels labeled as broncho-vascular are removed only a portion of the total pixels are removed, with the maximum number of pixels being the number of pixels which are labeled broncho-vascular.).

In regards to claim 5, A method as claimed in claim 4 comprising classifying the removed pixels as invalid pixels (col. 18, lines 5 – 18; col. 21, line 66 – col. 22, line 10: By classifying the pixels as broncho-vascular is the same as classifying them as invalid pixels.).

In regards to claim 11, A method as claimed in claim 5 comprising superimposing said pulmonary parenchyma pixels presented in false colors on said pixels presented in gray scale values, and replacing any pixels classified as invalid with corresponding pixels of said image in gray scale values (col. 21, line 66 – col. 22, line 10; col. 21, 52 – 65: Uppaluri discloses that the color image can be overlaid onto the gray scale image. Uppaluri also teaches that parts of the color image can be removed. However Uppaluri

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never explicitly teaches that both operations can be performed together. It would have been obvious to one having ordinary skill in the art to combine these two operations. Thus when the invalid pixels are removed the gray scale image below would be seen. Allowing the user to combine functions will allow the user to get a better understanding of the image and possibly allow the user to better diagnose the patient.).

In regards to claim 15, A method as claimed in claim 1 comprising obtaining a plurality of computed tomography images of said lung comprising, in combination, volume data from said subject, and for each of said images in said plurality of images, determining said pulmonary parenchyma pixels and generating a processed image wherein the pulmonary parenchyma pixels are presented in false colors and wherein the remaining image regions are presented in said gray scale values (col. 4, lines 23 – 28).

In regards to claim 16, A method as claimed in claim 15 comprising conducting a multi-planar image reconstruction of said volume data comprised of said plurality of images (col. 4, lines 23 – 28; col. 22, lines 55 – 62: Uppaluri states that the method can be performed on a set of images which are combined into one 3D image.).

In regards to claim 17, Uppaluri discloses processing a CT image to bring out the pulmonary parenchyma. However Uppaluri does not disclose subtracting a contrast agent-enhanced image from a non contrast agent-enhanced image.

Heuscher discloses subtracting a reference CT image which does not use a contrast agent from a contrast agent enhanced CT image in order to better detect blood vessels.

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to perform a subtraction operation between an enhanced CT image and a reference CT image. By performing this operation blood vessels can be better displayed for a physician to diagnose the lungs.

In regards to claim 18, claim 18 is rejected for the same reasons as claim 1. The argument similar to that presented above for claim 1 is applicable to claim 18. Claim 18 distinguishes from claim 1 in that it lists system parts. These parts are seen in Figure 13 of Uppaluri. The image input device is a scanner.

In regards to claim 19, claim 19 is rejected for the same reasons as claim 17. The argument analogous to that presented above for claim 17 is applicable to claim 19.

In regards to claim 20, A computed tomography apparatus as claimed in claim 18 comprising a user interface, including said display, connected to said processor, said user interface having an actuatable operating element for implementing the determination of pixels representing pulmonary parenchyma in said image and the display of said processed image (Figure 14 is an example of the user interface.).

In regards to claims 21 – 23, claims 21 – 23 are rejected for the same reasons as claims 18 – 20. The argument analogous to that presented above for claims 18 – 20 is applicable to claims 21 – 23.

3. Claims 6 – 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uppaluri as modified by Heuscher as applied to claim 5 above, and further in view of Wood (5,351,305).

In regards to claim 6, Uppaluri (as modified by Heuscher) does not disclose a smoothing operation on the pulmonary parenchyma. Uppaluri does teach of classifying tissue and thus performing an operation on only some of those classified groups would have been obvious.

Wood discloses (col. 3, line 65 – col. 4, line 19) performing a smoothing operation on a CT image using a smoothing filter.

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to perform a smoothing operation (as taught by Wood) on the pulmonary parenchyma identified by Uppaluri. Smoothing operations remove noise. By removing noise the user will not be confused by small random noise dots when performing a diagnosis.

In regards to claim 7, A method as claimed in claim 6 comprising conducting a sliding averaging of said pixels in said region containing said pulmonary parenchyma pixels as said smoothing operation (Wood: col. 3, line 65 – col. 4, line 19: A sliding average is what Wood performs. A filter moves over blocks of 11x11 pixels performing a smoothing. This is a sliding average.).

In regards to claim 8, A method as claimed in claim 6 comprising selecting only a plurality of pixels, from among said pixels in said region containing said pulmonary parenchyma pixels, for smoothing in said smoothing operation (Wood: col. 3, line 65 – col. 4, line 19: An 11x11 pixel block is away of selecting only a plurality of pixels.).

In regards to claim 9, A method as claimed in claim 8 comprising identifying a middle pixel in said plurality of pixels selected for said smoothing operation, and

conducting said smoothing operation by generating an average value of said plurality of pixels selected for said smoothing operation, referenced to said middle pixel (Wood: col. 3, line 65 – col. 4, line 19).

In regards to claim 10, A method as claimed in claim 9 comprising designating a minimum proportion of valid pixels among said plurality of pixels selected for said smoothing operation, and setting said middle pixel to an invalid status if said minimum proportion is not reached (Wood: col. 3, line 65 – col. 4, line 19: Any smoothing filter which is moved across an image area will eventually reach an edge of the image area. At some point, most likely when the middle pixel is past the edge it will be marked invalid and the rest of pixels under the filter will not be smoothed.).

4. Claims 12 – 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uppaluri as modified by Heuscher as applied to claim 1 above, and further in view of Krauss (5,253,281).

In regards to claim 12, Uppaluri teaches (col. 6, lines 34 – 42) that a histogram can be used to window the parenchyma pixels. However Uppaluri does not disclose performing a windowing operation on the gray scale. However Uppaluri teaches (col. 21, lines 2 – 5) that the contrast can be changed on the gray scale image.

Krauss teaches (col. 1, lines 43 – 47) that a gray scale x-ray image can be windowed to display the full brightness range.

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to perform windowing (as taught by Krauss) on the gray scale portion of the image in the method disclosed by Uppaluri. Performing this adjustment

will allow the gray scale image to fully utilize the range of gray scales, thus bringing out more detail for the physician to see.

In regards to claim 13, A method as claimed in claim 12 comprising windowing the pulmonary parenchyma pixels presented in false colors dependent on a histogram of said pulmonary parenchyma pixels (col. 6, lines 34 – 42).

In regards to claim 14, A method as claimed in claim 13 wherein said histogram has a center of gravity, and employing said center of gravity as a central value in said windowing of said pulmonary parenchyma pixels, and setting a width of a window in said windowing of said pulmonary parenchyma pixels to a fixed value of approximately 100 HU (col. 6, line 35 – col. 7, line 68: Every histogram relies on finding a “center of gravity” and pixels that fall within a certain distance of this center to identify regions.).

### ***Response to Arguments***

5. Applicant's arguments filed 12/12/05 have been fully considered but they are not persuasive.

6. The applicant's first argument begins on page 11 where it is stated that “Because Uppaluri et al reference define the color based on the spatial frequencies, there is no necessarily any relationship between the HU value that is associated with a particular pixel, and the color with which that pixel will be displayed”.

This assertion is incorrect. Uppaluri analyzes the HU values associated with pixels in several ways (first and second order measurements). This data is then used to classify regions of interest (col. 18, lines 5 – 20). The classified regions of interest are then colored (col. 20, lines 5 – 17).

7. The applicant states, "The false colors are displayed dependent on the respective Hu values of the pixels. Since the HU values can be relatively finely analyzed, slight differences in the HU values will produce noticeable color differences. In the present invention, any pixel that has the same HU value will be displayed with the same color, but this is not the case in the Uppaluri et al reference."

The examiner would like to encourage the applicant to include language in the independent claims to clearly bring out the points presented above. Currently the claimed language just requires that the false colors correspond to different HU values, which they would as the HU values are used in part to determine the classification of tissue type and thus color.

### ***Conclusion***

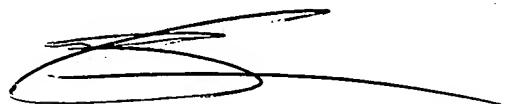
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher L. Lavin whose telephone number is 571-272-7392. The examiner can normally be reached on M - F (8:30 - 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh M. Mehta can be reached on (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Christopher Lavin

A handwritten signature in black ink, appearing to read 'Christopher Lavin', with a stylized, cursive script.A handwritten signature in black ink, appearing to read 'Brian Werner', with a stylized, cursive script.

**BRIAN WERNER**  
**PRIMARY EXAMINER**